PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTH	ORITY	•		
Tu: JOHN D. SIMMONS AKIN GUNIP STRAUSS HAUER & FELD LLP ONE COMMERCE SQUARE, SUIET 2200 2005 MARKET STREET PHILADELPHIA, PA 19103		PCT WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY		
	÷	Date of mailing (day/month/year)	21 SEP 2006	
Applicant's or agent's file reference		FOR FURTHER ACTION See paragraph 2 below		
681443-1WO International application No.	International filing date	(day/month/year)	Priority date (day/month/year)	
	21 April 2006 (21.04.2	(006)	22 April 2005 (22.04.2005)	
PCT/US06/15310 International Patent Classification (IPC)	or both national classific	ation and IPC		
IPC: H01L 21/336(2006.01),29/79				
USPC: 438/268,270;257/330				
Applicant ICEMOS TECHNOLOGY CORPORA	TION		•	
1. This opinion contains indications re	elating to the following it	ems:		
Box No. 1 Basis of the	ne opinion			
Box No. II Priority			industrial applicability	
Box No. III Non-estab	dishment of opinion with	regard to novelty, inv	rentive step and industrial applicability	
Box No. IV Lack of u	nity of invention		· industrial	
Box No. V Reasoned applicabil	statement under Rule 43. lity; citations and explana	bis.1(a)(i) with regard tions supporting such	to novelty, inventive step or industrial statement	
Box No. VI Certain documents cited				
Box No. VII Certain d	efects in the international	application		
Box No. VIII Certain observations on the international application				
2. FURTHER ACTION If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1 bis(b) that written opinions of this International Searching Authority will not be so considered.				
If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later. For further options, see Form PCT/ISA/220.				
3. For further details, see notes to Form PCT/ISA/220.				
Name and mailing address of the ISA/ US Date of completion of this Authorized officer				
Mail Stop PCT, Aun; ISA, US Commissioner for Patents	i spinion	•	Long Tran JUIIMIL (MCC)	
2.O. Box .450 A.exanoria, Virginia 22313-14	29 July 200	06 (29.07.2006)	Telephone No. 571-272-1797	
Framme No. 571(273-3201 From PCT ISA, 237 cover sneet) (Ap				

International application No.	
PCT/US06/15310	

INTERNATIONAL SEARCHING ACTIVE	
Box No. 1 Basis of this opinion	
1. With regard to the language, this opinion has been establi the international application in the language in a translation of the international application into international search (Rules 12.3(a) and 23.1(b)). 2. With regard to any nucleotide and/or amino acid sequenced invention, this opinion has been established on the active of material a sequence listing table(s) related to the sequence listing b. format of material on paper in electronic form	which it was filed , which is the language of a translation furnished for the purposes of guence disclosed in the international application and necessary to the
c. time of filing/furnishing contained in the international application as filed together with the international application furnished subsequently to this Authority for	ation in electronic form.
In addition, in the case that more than one versifiled or furnished, the required statements that the application as filed or does not go beyond the 4. Additional comments:	ion or copy of a sequence listing and/or table(s) relating thereto has been the information in the subsequent or additional copies is identical to that in the application as filed, as appropriate, were furnished.

International application No. PCT/US06/15310

Statement			
Novelty (N)	Claims	NONE	YES
INOVERTY (IV)	Claims	1-6,8-19,21-26	NO
	Claims	NONE	YES
Inventive step (1S)	Claims	1-26	
			YES
Industrial applicability (IA)	Claims	NONE	YES
	Claims	NONE	
Citations and explanations:			
ease See Continuation Sheet			
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Form PCT ISA. 237 (Box No. V) (April 2005)

International application No. PCT/US06/15310

 Supplemental Box
In case the space in any of the preceding boxes is not sufficient.
 V. 2. Citations and Explanations: Claims 1 - 6, 8 - 19, 21 - 26 lack novelty under PCT Article 33(2) as being anticipated by Nitta et al. (US Patent No. 6,307246). Claims 1 - 6, 8 - 19, 21 - 26 lack novelty under PCT Article 33(2) as being anticipated by Nitta et al. (US Patent No. 6,307246). Regarding claims 1, 2, 12, 13, 14, 15, 25 and 26, '246, figures 1 - 24, illustrates a method of manufacturing a semiconductor device comprising:
semiconductor substrate having a heavily doped region of a this conductivity type (n) at the first main surface; having a lightly doped region of the first conductivity type (n) at the first main surface; providing in the semiconductor substrate a plurality of trenches and a plurality of mesas with each mesa having an adjoining trench and a first extending portion extending an adjoining trench and a first extending portion extending from the first main surface toward the heavily doped region to a first depth position, at least one mesa having a first from the first main surface toward sidewall surface, each of the plurality of trenches having a bottom (column 5, lines 3 -

sidewall surface and a second sidewall surface, each of the plurality of trenches having a bottom (column 5, lines 3 doping with a dopant of a second conductivity type the first sidewall surface of the at least one mesa to form a 291: first doped region of the second conductivity type or of the first conductivity (column 5, lines 22 - 28);

doping with the dopant of the second conductivity type the second sidewall surface of the at least one mesa to form a second doped region of the second conductivity type, wherein diffusing the dopants of the second conductivity type into the at least one mesa prior to doping with the dopants of the first conductivity type(column 5, lines 3 - 39);

doping with a dopant of the first conductivity type the first sidewall surface of the at least one mesa to provide a second doped region of the first conductivity type at the first sidewall, and doping with the dopant of the first conductivity type the second sidewall surface of the at least one mesa to provide a fourth doped region of the first conductivity type at the second sidewall (column 13, lines 22 - 29; column 10, lines 15 - 26; column 13. lines 6 - 21):

diffusing a dopants of the second conductivity type into

lining at least the trenches (5a) adjacent to the at least one mesa with an oxide material by CVD (column 14, lines 46 - 521; and

International application No. PCT/US06/15310

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

filling at least the trenches (5a) adjacent to the at least one mesa with one of a semi-insulating material and an insulating material (column 13, lines 22 - 29).

Regarding claims 3, 4, 16 and 17, the '246 discloses forming a layer of undoped polysilicon, after the oxide lining step, over the trench bottoms and the mesas, each including the first and second sidewalls; filling the plurality of trenches with one of a semi-insulating material and an insulating material includes filling the plurality of trenches with a semi-insulating polycrystalline silicon (column 13, lines 22 - 29).

Regarding claims 5, 6, 18 and 19, the '246 discloses the first sidewall surface has a first predetermined inclination maintained relative to the first main surface and the second sidewall surface has a second predetermined inclination maintained relative to the first main surface, wherein the first and second sidewall surfaces are generally perpendicular relative to the first main surface.

Regarding claims 8 - 11 and 21 - 24, the '246 discloses the implanting of the dopant of the first and second conductivity types are both implanted at a predetermined angle (column 5, lines 32 - 33).

Claims 7 and 20 lack an inventive step under PCT Article 33(3) as being obvious over Nitta et al. (US Patent No. 6,307246) and Remarks.

Regarding claims 7 and 20, the '246 discloses the claimed invention of claim 1 or claim 14, respectively, but fails to teach the plurality of trenches are formed utilizing one or more of plasma eaching, reactive ion etching (R1E), sputter etching, vapor phase etching and chemical etching.

However, plasma etching, reactive ion etching (R1E), sputter etching, vapor phase etching and chemical etching are well known processes in the semiconductor art for forming trenches. It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize plasma etching, reactive ion etching (R1E), sputter etching, vapor phase etching and chemical etching to form trenches of the '246, since it has been held to be within the general skill of a worker in the art to select a known method on the basis of its suitability for the intended used method as a matter of obvious design choice.

PATENT COOPERATION TREATY

TERNATIONAL SEARCHING AU	THORITY		- ~~	
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ONE COMMERCE SQUARE, SUIET 2200 2005 MARKET STREET PHILADELPHIA, PA 19103		WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY		
,		(PCT Rule 43bis.1)		
		Date of mailing	91 055 0000	
		(day/month/year) FOR FURTHER	21 SEP 2006	
Applicant's or agent's file reference		See paragraph 2 below		
681443-1WO	International filing date	e (day/month/year)	Priority date (day/month/year)	
International application No.	21 April 2006 (21.04.:		22 April 2005 (22.04.2005)	
PCT/US06/15310 International Patent Classification (I	PC) or both national classific	cation and IPC		
USPC: 438/268,270;257/330				
Applicant				
ICEMOS TECHNOLOGY CORPO	RATION			
1. This opinion contains indication	as relating to the following i	tems:		
Box No. I Basis	of the opinion			
Box No. II Priori	ty	·		
Box No. III Non-e	stablishment of opinion with	regard to novelty, ir	nventive step and industrial applicability	
	of unity of invention		-	
57		3bis, 1(a)(i) with regar	rd to novelty, inventive step or industrial	
Box No. V Reason applies	cability; citations and explan	ations supporting suc	h statement	
DOX 1.0.	in documents cited			
Box No. VII Certa	in defects in the internations			
Box No. VIII	Certain observations on	the international app	dication	
2. FURTHER ACTION If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an International Preliminary Examination is made, this opinion will be considered to be a written opinion of the International Preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses and International Bureau under Rule 66.1 bis (b) Authority other than this open to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1 bis (b) that written opinions of this International Searching Authority will not be so considered.				
If this opinion is, as provided IPEA a written reply togeth mailing of Form PCT/ISA/2. For further options, see Form	20 or before the expiration of	written opinion of the amendments, before f 22 months from the	ne IPEA, the applicant is invited to submit to the re the expiration of 3 months from the date of e priority date, whichever expires later.	
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3. For further details, see notes			115	
Name and mailing address of the		ompletion of this	Authorized officer	
! Mad Stup 2CT, Altn: iSA	us		Long Tran Cullimit	
Commissioner for Patents 2.0. Box .450 A.exanuria, Virginia 22313-1450		006 (29.07.2006)	Telephone No. 571-272-1797	
' g. samue No. 571; 273-3201				
Form PCT ISA, 23" cover sneet)	(April 2005)		/	

International application No.	
PCT/US06/15310	

Box No	. I Basis of this opinion
\boxtimes	the international application in the language in which it was filed a translation of the international application into, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. With claime	regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the ed invention, this opinion has been established on the basis of:
a.	type of material a sequence listing table(s) related to the sequence listing
b.	format of material on paper in electronic form
c.	time of filing/furnishing contained in the international application as filed. filed together with the international application in electronic form. furnished subsequently to this Authority for the purposes of search.
3.	In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Add	ditional comments:

International application No. PCT/US06/15310

	INTERNATIONAL SEARCHIN	GAUTHORIT	1		-dustrial	
Box No. V Reasoned statement under Rule 43 bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement						
1. Statement						
	Navelny (NI)	Claims	NONE		YES	
	Novelty (N)	Claims	1-6,8-19,21-26		NO	
	Inventive step (IS)	Claims	NONE		YES	
		Claims	1-26			
		Oleten	1-26		YES	
	Industrial applicability (IA)	Claims	NONE		NO	
		Ciaiiiis	NONE			
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	ons and explanations:				ļ	
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Form PCT ISA. 237 (Box No. V) (April 2005)

International application No. PCT/US06/15310

Supplemental Box In case the space in any of the preceding boxes is not sufficient.	
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V. 2. Citations and Explanations:	MIS Palest No. 6 307246)
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semiconductor device comprising:	and main surfaces opposite to each other, the
semiconductor substrate having a heavily doped region of a first co	End main surface:
having a lightly doped region of the first conductivity type (ii) at an providing in the semiconductor substrate a plurality of tren	ches and a plurality of mesas with each mesa having
an adjoining trench and a first extending portion extending	double position at least one mesa having a first
sidewall surface and a second sidewall surface, each of the proteins	
doping with a dopant of a second conductivity type the first doped region of the second conductivity type or of the first cortist doped region of the second conductivity type or of the first cortists the second conductivity type the	t sidewall surface of the at least one mesa to form a ductivity (column 5, lines 22 - 28);
doping with the dopant of the second conductivity type	diffusing the dopants of the second conductivity
type into the at least one mesa prior to doping with the dopants of t	aidought surface of the
doping with a dopant of the first conductivity type the first	tractivity type at the first sidewall, and doping with
at least one mesa to provide a second doped region of the first conductivity type the second sidewall surface region of the first conductivity type at the second sidewall (column	13, lines 22 - 29; column 10, lines 15 - 26; column
13. lines 6 - 21):	
lining at least the trenches (5a) adjacent to the at least one	mesa with an oxide material by CVD (column 14.
1 Spec 16 - 521: and	

lines 46 - 521; and

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